

IN THE CLAIMS

Please amend the claims as indicated in the following List of Claims by canceling Claims 1-20 and adding new Claims 21-41. This list replaces all prior versions and listings of claims in the application.

1. - 20. (Canceled)

21. (New) A method for liquefying a gas (1) which comprises cooling a feed gas stream successively through three heat exchange zones (310, 311, 312) in respective first, second, and third temperature ranges to provide a liquefied product (13), wherein refrigeration for cooling the feed gas stream in the first temperature range is provided by a first vaporizing refrigerant (117), refrigeration for cooling the stream in the second temperature range is provided by a second vaporizing refrigerant (213), and refrigeration for cooling the stream in the third temperature range is provided by a third vaporizing refrigerant (315), the first, second, and third refrigerants being of different compositions from each other, characterized in that additional refrigeration is provided by vaporization (357, 379), at temperatures above the lowest temperature in the second heat exchange zone (311), of an auxiliary refrigerant (373, 377) derived from the third vaporizing refrigerant (315) vaporized in the third (coldest) heat exchange zone (312).

22. (New) A method of Claim 21, wherein the auxiliary refrigerant (373) is of the same composition as the refrigerant (315) vaporized in the coldest heat exchange zone (312) but is vaporized (357) at a different pressure.

23. (New) A method of Claim 22, wherein the refrigerant (315) for the coldest heat exchange zone (312) is provided by

(1) compressing (359) and cooling (363) a vaporized refrigerant (316) to provide an intermediate compressed refrigerant (365);

(2) combining the intermediate compressed refrigerant (365) with the vaporized auxiliary refrigerant (367) to provide a combined intermediate refrigerant;

(3) compressing (319) and cooling (320) the combined intermediate refrigerant to provide a cooled compressed refrigerant (328); and

(4) further cooling and condensing (357) the cooled compressed refrigerant (328) by indirect heat exchange with vaporizing auxiliary refrigerant (373) to provide a combined refrigerant (369), one portion (329) of which provides the refrigerant (315) for the coldest heat exchange zone (312) and another portion of which provides the auxiliary refrigerant (373).

24. (New) A method of Claim 21, wherein the auxiliary refrigerant (377) is of a different composition from the refrigerant (315) vaporized in the coldest heat exchange zone (312).

25. (New) A method of Claim 24, where in the auxiliary refrigerant (377) is provided by

(1) partially or fully vaporizing the refrigerant (315) in the coldest heat exchange zone (312) to provide a partially or fully vaporized warmed refrigerant (316); and

(2) combining the warmed refrigerant (316) with a cooled reduced-pressure (375) refrigerant to provide the auxiliary refrigerant (377);

and wherein the cooled reduced-pressure refrigerant is provided by

(3) vaporizing (379) the auxiliary refrigerant (377) to yield a vaporized auxiliary refrigerant (381);

(4) compressing (319) and cooling (320) the vaporized auxiliary refrigerant to provide a cooled, compressed, partially-condensed auxiliary refrigerant (328);

(5) separating (330) the cooled, compressed, partially-condensed auxiliary refrigerant (328) into a liquid fraction (383) and a vapor fraction (385);

(6) further cooling the liquid fraction (383) by indirect heat exchange (379) with the vaporizing auxiliary refrigerant (377) to provide a cooled liquid refrigerant (389); and

(7) reducing the pressure (375) of the cooled liquid refrigerant (389) to provide the cooled reduced-pressure (375) refrigerant.

26. (New) A method of Claim 21, wherein the feed gas stream (1) is a natural gas.

27. (New) A method of Claim 21, wherein the first refrigerant is a single or multi-component refrigerant and the second and third refrigerants are respective multi-component refrigerants.

28. (New) A method of Claim 21, wherein the first, second, and third refrigeration systems are separate closed loop systems.

29. (New) A method of Claim 21, wherein the first heat exchange zone (310) cools the feed gas stream to between -35°C and -55°C, the second heat exchange zone (311) cools the feed gas stream to between -40°C and -100°C, and the third heat exchange zone (312) cools the feed gas stream to between -85°C and -160°C.

30. (New) A method for liquefying a gas (1) which comprises cooling a feed gas stream successively through two heat exchange zones (311, 312) at respective first

and second temperature ranges to provide a liquefied product (13), wherein refrigeration for cooling the feed gas stream in the first temperature range is provided by a first vaporizing refrigerant (213), refrigeration for cooling the stream in the second temperature range is provided by a second vaporizing refrigerant (315), and additional refrigeration is provided by vaporization (357, 379), at temperatures above the lowest temperature in the first heat exchange zone (311), of an auxiliary refrigerant (373, 377) derived from the second vaporizing refrigerant (315) vaporized in the second (coldest) heat exchange zone (312), characterized in that the auxiliary refrigerant (373) is of the same composition as the refrigerant (315) vaporized in the coldest heat exchange zone (312) but is vaporized (375) at a different pressure.

31. (New) A method of Claim 30, wherein the refrigerant (315) for the coldest heat exchange zone (312) is provided by

(1) compressing (359) and cooling (363) a vaporized refrigerant (316) to provide an intermediate compressed refrigerant (365);

(2) combining the intermediate compressed refrigerant (365) with the vaporized auxiliary refrigerant (367) to provide a combined intermediate refrigerant;

(3) compressing (319) and cooling (320) the combined intermediate refrigerant to provide a cooled compressed refrigerant (328); and

(4) further cooling and condensing (357) the cooled compressed refrigerant (328) by indirect heat exchange with vaporizing auxiliary refrigerant (373) to provide a combined refrigerant (369), one portion (329) of which provides the refrigerant (315) for the coldest heat exchange zone (312) and another portion of which provides the auxiliary refrigerant (373).

32. (New) A method of Claim 30, wherein the feed gas stream (1) is a natural gas.

33. (New) A method of Claim 30, wherein the first refrigerant is a single or multi-component refrigerant and the second and third refrigerants are respective multi-component refrigerants.

34. (New) A method of Claim 30, wherein the first, second, and third refrigeration systems are separate closed loop systems.

35. (New) A method of Claim 30, wherein the first heat exchange zone (310) cools the feed gas stream to between -35°C and -55°C, the second heat exchange zone (311) cools the feed gas stream to between -40°C and -100°C, and the third heat exchange zone (312) cools the feed gas stream to between -85°C and -160°C.

36. (New) A system for liquefying a gas stream (1) by a method of Claim 21, which system comprises three heat exchange zones (310, 311, 312) for cooling the gas stream (1) successively through first, second, and third respective temperature ranges to provide a liquefied product (13) and respective refrigeration systems for providing respective first, second, and third refrigerants (117, 213, 315) of different compositions to each other to the heat exchange zones (310, 311, 312), characterized in that a further heat exchange zone (375, 379) is present to vaporize, at temperatures above the lowest temperature of the second heat exchange zone (311), an auxiliary refrigerant (373, 377) derived from the third refrigerant (315) vaporized in the third (coldest) heat exchange zone (312).

37. (New) A system of Claim 36, wherein the auxiliary refrigerant (373) is of the same composition as the refrigerant (315) vaporized in the coldest heat exchange zone (312), but is vaporized in the further heat exchange zone (357) at a different pressure.

38. (New) A system of Claim 36 or Claim 37, comprising

means for compressing (359) and cooling (363) a vaporized refrigerant (316) to provide an intermediate compressed refrigerant (365);

means for combining the intermediate compressed refrigerant (365) with the vaporized auxiliary refrigerant (367) to provide a combined intermediate refrigerant; and

means for compressing (319) and cooling (320) the combined intermediate refrigerant to provide a cooled compressed refrigerant (328);

and wherein the further heat exchange means (357) further cools and condenses the cooled compressed refrigerant (328) by indirect heat exchange with vaporizing auxiliary refrigerant (373) to provide a combined refrigerant (369), one portion (329) of which provides the refrigerant (315) for the coldest heat exchange zone (312) and another portion of which provides the auxiliary refrigerant (373).

39. (New) A system of Claim 36 or Claim 37, wherein the auxiliary refrigerant (377) is vaporized in the further heat exchanger to yield a vaporized auxiliary refrigerant (381) and the system comprises:

means for combining partially or fully vaporized warmed refrigerant (316) from the coldest heat exchange zone (312) with a cooled reduced-pressure (375) refrigerant to provide the auxiliary refrigerant (377);

means for compressing (319) and cooling (320) the vaporized auxiliary refrigerant to provide a cooled, compressed, partially-condensed auxiliary refrigerant (328);

means for separating (330) the cooled, compressed, partially-condensed auxiliary refrigerant (328) into a liquid fraction (383) and a vapor fraction (385);

means for further cooling the liquid fraction (383) by indirect heat exchange (379) with the vaporizing auxiliary refrigerant (377) to provide a cooled liquid refrigerant (389); and

means (375) for reducing the pressure of the cooled liquid refrigerant (389) to provide the cooled reduced-pressure (375) refrigerant.

40. (New) A system for liquefying a gas stream (1) by a method of Claim 30, which system comprises two heat exchange zones (311, 312) for cooling the gas stream (1) successively through respective first and second temperature ranges to provide a liquefied product (13), respective first and second refrigeration systems for providing respective refrigerants (213, 315) to the heat exchange zones (311, 312), and a further heat exchange zone (357, 379) to vaporize, at temperatures above the lowest temperature in the first heat exchange zone (311), an auxiliary refrigerant (373, 377) derived from the refrigerant (315) vaporized in the zone (312), characterized in that the auxiliary refrigerant (373) is of the same composition as the refrigerant (315) vaporized in the coldest heat exchange zone (312) but is vaporized in the further heat exchange zone (357) at a different pressure.

41. (New) A system of Claim 40 comprising

means for compressing (359) and cooling (363) a vaporized refrigerant (316) to provide an intermediate compressed refrigerant (365);

means for combining the intermediate compressed refrigerant (365) with the vaporized auxiliary refrigerant (367) to provide a combined intermediate refrigerant; and

means for compressing (319) and cooling (320) the combined intermediate refrigerant to provide a cooled compressed refrigerant (328);

and wherein the further heat exchange means (357) further cools and condenses the cooled compressed refrigerant (328) by indirect heat exchange with vaporizing

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auxiliary refrigerant (373) to provide a combined refrigerant (369), one portion (329) of which provides the refrigerant (315) for the coldest heat exchange zone (312) and another portion of which provides the auxiliary refrigerant (373).